[MUSIC PLAYING]

DR. JAMES D. LUKETICH: What you're going to see is a culmination of, really, over 20 years of work, of advancing the field of esophageal surgery. Some of my early fellows are now department chairs. I'm going to be visiting with Ninh Nguyen later this week, who's the chair at UC Irvine, and participated in some of these very early procedures to attempt to do minimally invasive esophagectomy. And I'll explain how that worked.

How did it work for me? Well, and I wanted to share some of this with the candidates, because when you look at a career, and you're kind of overwhelmed, like, oh, how do I get there? 400 papers. I mean, I actually wrote a couple of them.

You surround yourself with the winners, and it will only bring you higher. We often say, standing on the shoulders of giants, and I got to do that a lot and early in my career. So my residency exposed me to a lot of open surgery at Penn. And instead of graduating with the required six esophagectomies, I graduated with something, like, 60, and then going on to Memorial Sloan Kettering and Cornell, working with people, like Bob Ginsberg, and Michael Burt and some of the superstars in, I believe, Memorial. Still one of the top places, but at the time, I believe, it was clearly the top place to train for thoracic surgery anywhere in the world.

And they only took one a year, so I was challenged to how do you get into a place like that. And it took a lot of hard work and a lot of luck when you really look at it, because you're competing against-- just like you are competing against-- quite a competitive pool. But you will get there if you set your goals and remain focused.

I was interested in esophagus cancer from the beginning. Some of it, again, was being in the right place at the right time and choosing a disease that happened to be growing. If I would have chosen mesothelioma, I may not be the chairman here today, because it's been a very flat disease, a very devastating disease. Advances haven't been so easy, but with esophagus cancer, I didn't know it was going to change. But you'll see with some of the slides, indeed, it did change, and some of the advances that took place were not just in surgery.

Fortunately, I worked here with a number of PhDs that actually developed PET scanning here. So I was able to write one of the first papers on PET scanning and esophageal cancer. Molecular staging-- fortunately, during my medical school years and prior, I got an opportunity to work in the lab, as many of you have that I've talked to over the last day or two. And that allowed me to get, what I would say, some scientific principles under my belt.

I got a master's degree from Vanderbilt in biochemistry and spent time in the lab in the Harrison department at the University of Pennsylvania, which was very helpful to develop a scientific method for me to be able to apply to other problems. So that was important.

And I was in an era, where, as an intern, before I went into the lab, we were doing all open gallbladders. It was a big subcostal incision. Typically, some of you may remember-- Dr. Wilson, I know, is old enough to remember-- they were in bed for a good week afterwards.

I remember one unfortunate case. 27-year-old lady had a gall bladder, was still in bed at about day seven with an NG tube, because everybody was waiting for her to pass flatus before they would remove the NG tube. And that was the big question everybody wondered. Have you passed gas yet? And we thought that if you took it out before you passed gas, you were going to bloat and maybe do lots of bad things. And some people do, so it wasn't entirely crazy.

But really, what we didn't know is if we got them out of bed earlier, and walked them, and move them, we probably would overcome any of those, as we do today. So that's what I was seeing. And wouldn't you know, that particular patient later that day, there was a code. And I'm called up as the junior resident just out of medical school. And she was coded and died from massive PE.

So that was a vivid reminder to me of the consequences of open surgery. But that was the standard in the day. And we did gallbladders pretty well. The mortality rate was actually quite low-- low single digits. I'd have to say near zero but not zero. And some of the things that occurred, like the morbidity after that incision, stuck with me.

Then I went into the lab, and I came out, and we started lap choles. Of course, there was a whole host of complications, which I'm sure Dr. Wilson and a few of the more senior surgeons in the room will remember. And this was a two or three-step operation. Grab the gallbladder cystic artery duct and vein, and you're done.

How can you screw that up? Well, you can screw it up in a variety of ways. You were used to a big subcostal incision with a Bookwalter retratctor. You're looking at these three structures. Then it was a really fun operation for an intern and a junior resident. The opening, the closing-- it was a major deal.

So when we started doing it laparoscopically, if you've ever been in a room with someone trying to do something relatively new, whether that's their first minimally invasive mitral or their first robotic case, you're going to see that things don't always look so pretty. There's a smeared camera, the view. You're going, what is that structure? Is that really where I want to be? And some surgeons will put minimally invasive ahead of safety and, therefore, mistakes were made.

So we had a whole host for, really, over a year or two, maybe three. Bile duct injuries that we never saw. People coming in with bile ascites. People coming in with liver failure from a damaged duct. They didn't clip the cystic duct. They clipped the major duct. So lots of complications were occurring.

Now when you got into a good view, it was remarkable. And I had the good fortune as an intern to scrub with a lot of gynecologists. And they were way, way ahead of the curve. It's amazing, because when I was watching them do tubal ligations, frequently, the c3cum and the colon in the way.

And what are you looking at? You're looking at this little worm appendix and say, well, couldn't we just take the appendix out right now? And someone says, oh, yeah, well, that's the general surgeon. You talk to a general surgeon. Well, can't you just put-- oh, no. Do a little McBurney incision, which was actually a little bit morbid.

And the view you got there, what if it wasn't appendectomy? I can tell you that appendix was going in the bucket. But today, you get a scope and you look. It might be an ovarian cyst. It could be lots of things. You might be looking at a totally normal appendix.

So when I came out of the lab and saw this remarkable change in anatomy and how we did things, I was impressed. And I really fell in love with minimally invasive surgery. I immediately started thinking about lobectomies in pigs and what's the next step. And for the most part, we're going to do gall bladders, nothing else. And that's the way it went for almost a decade.

'91 came down. [INAUDIBLE] doing the first lap Nissen over in France. And even that, which was a relatively straightforward operation, took over a decade to get to because of the complications and the reluctance of many, many surgeons to say, wait a minute. What about the do-no-harm principle that we all agreed to? What happened to that? We were doing pretty darn good with open gallbladders, then we went through this big period of complications.

Now today, I think that many people would say a lab chole is a pretty simple operation. And we've gotten the technology down and, I think, the anatomies down. And for the most part, I think it's way easier than open. But at the time, it wasn't so easy, and there were lots of complications.

So going to the next step of minimally invasive surgery was a big deal. And thinking about esophagectomy, which, arguably, is 200 steps, not three, so how do you get there? Well, I think you have to do a lot of open surgery, at least, that's what I had to do to get there.

Will you all have the experience of doing open esophagectomies? If you come here, you will. Why? Because we do see gunshot wounds. We do see advanced cases, perforations, bore hobbies. There are bona fide reasons to open.

Cadaver labs help. Simulation-- not so great for esophagectomy. May be some steps, like the anastamosis or the pyloroplasty in an animal model. Sure, that can be helpful. But for the most part, you're going to get it by on-the-job training. And so open esophagectomy morbidity was significant. We'll talk about it and then some of the objectives of minimally invasive.

But it was clear there was an opportunity, because you saw the gallbladder go from quite a vivid memory of a mortal open operation to an overnight stay and now, today, outpatient. And for the most part, surgeons are pretty good at that operation today.

And thinking about getting to esophagectomy was unthinkable by most surgeons, by most powers that be. It was never going to happen. So I think the question of, can a surgeon accomplish the operative approach of their choice in a minimally invasive fashion, I think the answer is yes. And I'll show you how we got there. And you've seen it happen in other disease processes, too. It may have taken 20 years, but it's there. We're there today.

Using evidence-based medicine, can we determine the ideal approach to esophagectomy-- open or minimally evasive? In other words, McKeown, Ivor Lewis, transhiatal-- that's still debated. Should we do a radical lymph node dissection or just sampling? How many nodes should you take-- 15 or now more than 20? So lots of, still, unknowns about how we should do this operation.

This was my experience leading to me getting the first MI at Pitt here in 1996 with Ninh Nguyen and Phil Schauer, one of my colleagues from general surgery. So I got to do a lot of surgery. I did 60 esophagectomies when I was at Penn. I did 88 as a CT resident. And there are some of my mentors. Thanks to them, because when I came here, I can remember my first weekend.

I'm getting transfers in from everywhere, because I had probably done more esophagectomies than anybody in the state, bar no one, except maybe Ernest Rosato, who I trained under at Philadelphia. So the referral pattern was robust.

And when I first came here to interview, Dr. Bart Griffith was the chief. And he said, Jim, I don't think there's much esophagus work to be had around here. We don't see much. And I said, well, I think maybe that could develop. And he said, well, you're going to need to do lung transplants, too.

So I had to go to the Cleveland Clinic, do a lung transplant fellowship before I could come here, which I did. And I didn't have to do very many lung transplants. I guess, if I had to help Pablo today, he could get me through it. But I gave that up a long time ago. But it was unknown if we could develop an esophageal service or practice.

I felt confident that I could. And that training-- thanks to a lot of my own mentors-- was I exposed to minimally invasive surgery? Yes, the gallbladder, the simulators-- they were there. The new technology-- back then, you worked closely with the reps, US surgical. They were your buddies, the people from Gore. And the money flowed like water.

At one point in time during my first two years, I was sitting on $20 million in industry grants here. And my lab was humming. I had over 100 papers in my first year or two. And I went to the powers that be and said, well, I'm thinking about promotion. They said, you mean, non-tenure stream? I said, no, I wasn't thinking of non-tenure stream. And they said, well, you don't have any peer reviewed grants.

I said, well, I don't need them. I have a $20 million industry grant. They said, no, if you want to climb the tenure stream, you need to do peer reviewed funding and peer reviewed publishing. So I wrote all at once, and they were funded pretty readily. Because at the time, the scores weren't so difficult and also, I had a lot of resources. So I was lucky in some ways, and I had some experience.

Working here-- I came here originally to join Ron Landry now. And I can remember meeting Rod on the first interview and wondering if I made the right decision. Rod's a little frenetic, if you've ever met him, but he was the consummate innovator-- always wanting to push the envelope a little further. And so I was drawn to that innovation and also, the innovation at Pitt led Jonas Salk to come here. It led Tom Starzl to come here. So there was a legacy of thinking out of the box here.

And meeting Tom Starzl and Hank Bahnson, who was really one of the first innovators of VADs in lung transplant and heart transplant, I would get little notes from these guys. Keep up the good work, Jim. I'm thinking, Hank Bahnson knows who I am? Because he was retired at that time. And Tom Starzl sending me a note.

It was amazing that these guys would look at what I'm doing, be aware of it, and encourage me to push it a little further, encourage me to push the envelope. And after the first minimally invasive esophagectomy, it was really exciting times. But all the people here helped me to some degree. And if you're going to join a department where you want to be innovative, you need to have support from the administration, from the residency program, from your colleagues, and from outside people. And I listed some of them at the bottom that were instrumental in my own career.

Now sometimes choosing the right disease, as I mentioned, isn't bad to be lucky. And when I say lucky, I had no idea that-- let's see. Is this working? Do you know?

SPEAKER 1: There's two up there. One should.

DR. JAMES D. LUKETICH: Might be working. Maybe I pushed the wrong button. I don't know.

SPEAKER 1: Yeah, it's working.

DR. JAMES D. LUKETICH: OK, is it the top one?

SPEAKER 1: It might not show up on the TV.

DR. JAMES D. LUKETICH: Yeah, OK. Well, we'll skip the pointer.

SPEAKER 1: You can use the arrow on the pointer.

DR. JAMES D. LUKETICH: I'll be OK. Anyway, so the point here is this was back in the '80s when I was getting started. And this is the curve of adenocarcinoma of the esophagus in Caucasian males. So that was a dramatic increase. The NCI has since looked at these numbers and said, this represents a 600% increase over time.

Now the numbers went from something like 9,000, 18,000 today. And it doesn't really show any evidence that it's leveling off. So how could you predict that you were going to be in a whirlwind of a disease process that has risen at a rate that's never been recorded for any other cancer? You couldn't.

So some things you just happened to be in the right place at the right time. And if you were interested in esophagus disorders, you were in the right place. And the NCI wanted you to do work along those lines. So there were a lot of RFAs-- Requests For Applications-- and I made a lot of applications and got a lot of grants, and we did a lot of work.

Because nobody still knows exactly what's going on with this. You might say, oh, yeah, it's reflux. Well, we were refluxing 40 years ago. Why didn't it occur then? Some people would say medicines. Maybe it's the PPIs that changed the local milieu. Maybe, but it's not that clear that people on PPIs get cancer, and people off PPIs don't. It's not clear at all.

So we still really don't know what's going on. We know that, even African American males are affected. Females, to some degree, but not nearly as much as that Caucasian, white-collar guy that doesn't know that he was doing anything bad, not necessarily at all an alcohol drinker and smoking. That was squamous cell and still is. In certain belts of the country, certain populations, there's still squamous cell cancer. Often was referred to as a Skid Row cancer-- the guys that are drinking heavily, chewing tobacco, and smoking. And that may be true to some degree. If you go to South Carolina, you're going to see that in the tobacco belt.

But for this cancer, you'd talk to people. You ever smoked? No. Drink? No. A little bit of heartburn and some would even deny much heartburn. So what's going on with this disease? If you're interested in investigating as part of your career, it's wide open.

We really don't know who's going to get it, when they're going to get it, how to test for it. Is it going to be a liquid biopsy? Is it blood based biopsy for DNA fragments? I don't know. We've had some success with that. But the questions and the answers-- there are way more questions than answers. Sometimes we look at things and, oh, everything's been figured out already. No, not with this disease and not with many when you really get down to it. So esophagus diseases, esophagus cancer-- wide open.

This is another curve showing a little more dramatically compared to other cancers. And as I mentioned, the other cancers have never risen at this rate. Melanoma is going up from sun exposure, but still, look at the esophagus, adenocarcinomas. It's really phenomenal. And

I can remember, in some of my early clinics, going in, and I'd have, like, eight new esophagus cancer patients in one clinic. That was unheard of. My volumes rose dramatically. And I was doing all the time thoracoabdominals. I loved the operation. I learned at the Cleveland Clinic with Tom Rice and with Ginsburg and others. It gave you great exposure. Node dissection was no-brainer.

And I was pretty good at it. I had my mortality rate down low to low single digits. It was rare that we lost a patient. But there were complications. Hospital stays were longer. The morbidity was significant. So I was very anxious to find a better way. These are just some of the other trends in the cancer and mortality.

So picking esophagus cancer and staying focused can be very similar to other disease processes. And I'm not going to compare myself to Tom Starzl, but his career catapulted because he stayed focused. He was going to figure out liver transplant come hell or high water. And if it wasn't in Colorado, then it was going to be somewhere else that would allow him to do what he wanted to do. And so Tom [INAUDIBLE], the dean at the time, Hank Bahnson, the chief of CT, who was very innovative, got Tom Starzl here because of the open atmosphere.

Because I can tell you, back in the day, this was not a place to come to train for general surgery. I didn't even interview, because your whole residency was taking care of the 600-or-so liver transplants they were doing every year. And as an intern and resident in general surgery, you weren't doing much, but scrambling to save lives and pump blood. You weren't doing the liver transplants for sure.

So this was not a place at the time to come to train in general surgery. That's changed. Now, it's a balanced environment. And I would say the same was true for this department before it was a department. Years ago, it was heavy VADs and transplant. Lots of innovation going on, but not a lot of routine aortic work, or mitral, or valves, or, certainly, not a lot of esophagus and lung work. So we-- I and others-- Pete Fearson, my partner, and with help from people like Dave Wilson, we had a lot of building to do if we were going to grow thoracic.

We are doing about 300 cases a year when I came here. And last year, we did 16,000 general thoracic cases. So there was a lot of growth. So I set some goals based on my own experiences in residency and what I saw important landmarks that had to take place to make some impact on this disease.

And one was molecular staging. We knew some things about esophagus cancer that I'll show you. But I thought that that was an important area, and I had some experience with that. Then the actual clinical staging was so inaccurate and still is today, as you'll see, to some degree. We've gotten better at it. And then, of course, my last go was could we actually do this minimally invasively.

This is a slide. It tells you that the lymph nodes were important. This is work from Toni Lerut in Belgium. I visited him many times. He's been here, spent months here. We've brought him here now as a retired sabbatical surgeon, and we like to do that. The residents love it, because he spends time in the OR, spends time in the clinics with you, and it's a lot of fun.

But this was his work. There was no PET scanning, nothing else. It was simply doing an operation and taking on, essentially, all the regional lymph nodes. And what he found-- if you did that, you could stage the patients very well. There was a subset. They had a 90% survival, those with negative nodes. Weren't very many, but there was a subset.

There was a subset that probably didn't need chemo that were early stage, but you had 70% to 80% survival. If you resected them all, you wound with one or two nodes. They still did quite well. And then there were those, where the mortality rate dropped, but remarkably, his results were unbelievable.

And this pointed out to me, if you had a group presenting-- you can imagine if this was 500 patients-- and you wanted to give them neoadjuvant therapy, why would you give the top curve neoadjuvant therapy? Would that make any sense to have a knee jerk reaction to every single patient with adenocarcinoma of the esophagus? Absolutely not.

But how would we know this before surgery? We didn't have PET scanning. Ultrasound was fairly rudimentary, and it's still inaccurate today. And PET scanning, I'll tell you, is only about 50% sensitive in picking up positive lymph nodes in esophagus cancer. So how do you get this information pre-op? It's still challenging.

It tells you the importance of staging and how elusive It's been for us with esophagus cancer having three fields of lymph nodes. But Toni Lerut data was, nevertheless, very impressive.

Now recognizing these problems with staging, the CALGB, one of the oncology groups in the country, said, well, we're going to try to stage cancer, kind of like a mediastinoscopy. We're going to develop a laparoscopic staging. The problem is, if you've ever been on a laparoscopic esophagus case, it's deep in the body, wedged between the heart, the aorta, the thoracic duct, other structures. So how do you pop out lymph nodes through VATS or laparoscopically?

Well, it was challenging, but if you did it, you spent the time doing it and actually staged these patients. You could find that there were marked changes in staging when you did it laparoscopically, thorocoscopically actually took a node out and sampled versus saying positive by ultrasound, or MRI, or CT scan at the time.

So we figured out that maybe we could do this. For me, the importance of this trial was that I was unwilling to come out of the OR without at least five lymph nodes. And for the most part, that's not what happened in this trial. People were going in, putting a scope, and say, well, there's no liver mets, so we're going to call it an early stage cancer.

But I dug around and said, no, you've got to find lymph nodes-- infradiaphragmatic, supradiaphragmatic, third field. And so I got really good at mobilizing esophagus. And I can remember early-- this was in '95-- saying, you know what? I think we could keep going. I can mobilize the esophagus. I'm comfortable working around it. And I'd done, in my training, over 150 esophagectomies, so I wasn't worried about an emergency conversion. I'd convert it in a heartbeat if I have to.

But I wasn't really worried about whether I was going to cause injury. I had that experience and the skill that I could avoid the injury. And now, with the skills of mobilizing the esophagus, it started to become more realistic that maybe we could pull this off.

So anyway, it led to some studies that were important at the time. But I wouldn't tell you today that laparoscopic, thoracoscopic staging is routine. I'd say, laparoscopic staging is for an adenocarcinoma esophagus. Why? Because we start every operation today pretty much in the belly. Because most people are doing Ivor Lewis, and I'll show you why.

But it means that, even if you're planning to open, you start with laparoscope. You're going to find a lot of information, whether it's peritoneal studding that was missed by CT, or an occasional liver met that's missed, or just some really fixed gastrohepatic lymph nodes. And you say, hey, this is a better case for chemo RT or chemo alone. You make that decision.

So these things were helpful for us to make decisions about how we were going to approach it. But importantly, we found that staging, at the time and even now, is pretty inaccurate. So if you really want to know what you're dealing with, we put the laparoscope in. Do I do that on every single patient? Well, I think, ultimately, you do. But if I see an obvious T3, N1, or T3, N2 with biopsy-proven lymph nodes by EUS, yeah, of course, you might go straight to chemo and skip that staging part.

Now when PET scanning came out, it had the promise it was going to change everything. But now, we had a device. It was not going to just look at anatomic abnormalities, but there was going to be a correlate with what's going on at the metabolic level. So if you gave FDG-18 glucose, you thought and hoped that the cancer would be metabolically active. It would pick up enough focal uptake. You could identify it on the PET scan. And on a good day, that's exactly what happened.

So we did the first study on 100 patients with esophagus cancer compared to minimally invasive surgery. So we compared it to the gold standard, which was the gold standard at time. And we found PET still fell short. It wasn't great. It was pretty good when it said there was a node positive, a celiac, it probably was a positive node, not nearly as many false positives as lung. But remember, lung is a filter. Esophagus is not a filter.

So if you see a large paraesophageal lymph node that's hot on PET, probably cancer. But you're going to miss a lot of small nodes. Sensitivity is not so good. So this was an important study, but it really pointed out that we're not done.

And there was a promise of all these new markers, these new tracers that were going to come out for specific for prostate, or lung, or whatever with PET scanning. None of that's really actually occurred. There've been a few trials looking at it, but for the most part, we still use FDG-18 glucose in most centers in the world. And these are the numbers. We haven't really improved it very much.

Using PET CT helped a little bit. But at the time, we were seeing things like this-- negative bone scans, positive PET scan. So you can imagine the excitement about PET scanning when it first came out. This was a great thing. But we were also seeing this-- negative PET scan and boom, a liver met. Put the scope in and say, OK, what's the deal here?

Maybe it wasn't very metabolically active. If it was below the size of a cubic centimeter, even today, it won't be consistently picked up by PET scanning. Now we're getting better with one millimeter CT slices. And in some cases, MRI could have a role.

Now it was great when we had an actual positive node. When you saw this-- and this is actually a patient of ours that we just saw in clinic the other day-- this wasn't a true celiac node. This was actually above the trifurcation of the celiac, and the splenic, and the hepatic, and the left gastric, which many celiacs were mislabeled, even today. But nevertheless, he had a very hot node, and we put him through our chemo protocol here in surgery. And he's still alive today, doing great.

So those were the numbers for PET scanning. So it was better than we were doing with CT, but we missed a lot of small lymph nodes that were actually malignant. So I wouldn't say that we're done with staging. Now EUS, it's helpful, but it's abounds with accuracies.

And when you think about EUS, you'd think there'd be a lot of great studies that did EUS pre-op, mapped the nodes, and actually labeled and said, these are the ones that are positive, and then go to surgery and do a radical esophagectomy, and try to coil it and see how good are you at it. Well, almost no studies like that.

So when you actually look at it, we're not so good with EUS as we think we are. Yes, if you see a T3 tumor in FNA of a bulk of lymph nodes, you can prove that you have nodal disease. But can you really stage the patient? Well, not always. And we found that there were some features on EUS that were important. When the lymph node's big, hypoechoic, distinct margin that rounds up, if you have all four of those features, you're pretty accurate, 80%.

But not very many lymph nodes have all four features. Actually, only 25% have all those features. So that means a lot of lymph nodes look marginal or negative on EUS, and they're actually positive. So the sensitivity is not so good.

Now why are we so focused on lymph nodes and staging? Well, this was a study by Akiyama, and it just looked like it had a big group of esophagus cancer patients. And what he found that if you were negative in the mediastinum, negative in the abdomen for lymph nodes, your five-year survival was 52%. Now if you remember Lerut slide, when his patients were node negative, his survival was 90%. Now why is that?

Well, it makes you wonder, how many nodes did they take out in this study? Six, eight, 10? It wasn't stated, so there were some limitations of, how many nodes do we have to take before we actually are doing a good job of staging? And that same problem exists for lung cancer and other problems. But you could see that when lymph nodes started to become positive, it even got worse.

So our goal was, could we figure out-- there were two possibilities. Either they weren't getting enough lymph nodes, or the lymph nodes that were taken out weren't studied carefully enough. That is maybe they're doing a single slice or two. And we know by numerous studies today that if you do multiple slice of the lymph node, you're going to find more lymph nodes positive.

And my thought was, could we do molecular staging on these negative histologic nodes to improve our ability to determine going from the Akiyama data to the Lerut data. Now the Lerut data was radical esophagectomy. Take out 50 lymph nodes. If they're all negative, 90% five-year survival. Akiyama said, negative, negative, 52% survival. So we wondered, what's going on? Is this occult metastases in the lymph node somewhere or what?

So that was my interest in going back to this slide and saying, wait a minute. There's a discrepancy here. So can we make that jump to better stage patients using molecular studies? And these were the questions about why do node-negative patients recur. In lung cancer, we see it. Stage 1 lung cancer-- 80% five-year survival in most series. There are a few cherry-picked series-- T1As, a lot of lymph nodes taken out, where you might see that survival bump up a little higher.

But nevertheless, there's a lot of reasons why patients with negative nodes may die of their cancer. And one is poor surgical sampling. And Nabil Rizk, one of Netyu's colleagues-- and Netyu helped with this study-- was looking at, retrospectively, a large group of patients, how they did, and then looking at the nodes and seeing could you have predicted they were going to do badly just by their pathologic staging.

And the answer was yes, but only if you took 18 lymph nodes. If you took six or eight, you had no clue how they were going to do in the long run. So this was a landmark study. It really helped surgeons understand that, hey, lymph node staging is actually critical to determining who should get chemo or not, just like going back to Lerut stage. If you knew you had a 90% survival, you're not going to give that group chemo.

On the other hand, if you knew you had T3, N2, and they're 20%, 30% five-year survival, those are the ones you got to target for chemo. So this was steps along the way that helped us understand what did we need to do to better stage patients, to stratify them, to surgery-- chemo first, chemoradiation, or, possibly, in some cases, no surgery at all.

Now we also knew that routine pathology can miss things. One single slice or two, you may miss it. So can molecular analysis yield information that would be clinically important? So we started studying molecular markers.

We looked at 34 different markers, and you've heard of CEA, and CK-19, [INAUDIBLE] 1, et cetera. These are tumor markers that people have looked at trying to determine, if you took a group of lymph nodes or a bone marrow biopsy, and you did routine histology on it and it was negative, and now, you did molecular staging. You found some of these markers. Could you predict who's going to recur with their cancer? And that was the goal of our study.

So when we looked at all these markers, what's a good marker? Well, a good marker would be one that's always positive in the tumor. So CEA is a very good marker from that standpoint. In adenocarcinoma, you take that lymph node that's got cancer and study it or the tumor, and it's going to be positive. So whether it's a tumor or a positive lymph node, it's going to be positive.

Now, let's say you took a group of benign lymph nodes. Now can you take benign lymph nodes from a cancer patient? Not really, because those are the one we don't know about, right? We worries they have occult metastases. So all these came from patents with GERD. So we had to sign up a large group of patients for clinical trials for studying. So we have a big bank of tissue here from patients with benign disease, because those are the perfect lymph nodes to study.

And when we did RTPCR on them, we found that, even if we ramped up the number of cycles of RTPCR, now, you have to have a cut-off. For those of you that have done RTPCR, have studied it a little bit, you understand that these markers are actually ubiquitous. CEA is everywhere in your body if you look hard enough for it, so is CK-7, CK-19, [INAUDIBLE] 1. They're all there.

So this is an ROC curve, looking at cycles of RTPCR and positivity. Because if you run enough cycles, you're going to get positive. And if you only do a simple signal, like we did in the old days-- gel-based RTPCR, if you remember those studies-- the answer was positive, yes, no. We had no ability to quantitate markers in the early days, and then came along quantitative RTPCR.

And our grants exploded at that time. I was working with Tony Godfrey. His wife happened to be here. Jenny Lidle joined our program to become a CT surgeon. She's now the chief at BU. And he was a brilliant investigator doing RTPCR for other things. And I met them during the interviews, and Tony and I started talking. And we came up with some ideas that we could use this with esophagus cancer, lung cancer.

And then with the quantitative RTPCR, we were able to do studies like this and identified six markers that were pretty good. The ideal marker, the perfect marker would be, if you could find the number of cycles, and it was always positive in the tumor, always positive in a positive lymph node-- histologically positive-- and then your group of GERD patients always negative.

So is there that perfect marker? Well, no, there's not, partly because these are ubiquitous. They are present in every tissue in the body if you look hard enough. But by looking at this, we were able to identify a group of markers that were pretty valuable. And sometimes, we combined two markers.

And so what we were able to do was look at a group of patients that were histologically negative. All of these patients were negative histologically, and all had a minimum of 10 lymph node study. So theoretically, this should be the group that looked like Toni Lerut curve, right? Histo negative in a large number of lymph nodes. They should all be 90% five-year survivals. At worst, they should be Akiyama's. Akiyama had 52% five-year survival. He didn't study as many nodes. All histologically based. If you're negative histologically in the abdomen and chest, you had a 52% survival in Akiyama's data.

Toni Lerut said, if you were negative, negative, negative in the neck, too, you had a 90% five-year survival. What we found is, if we studied these markers, this was all histo-negative. But if the markers were positive, they were all dead by 20 months. So this might explain what's going on with node-negative patients that are dying of cancer. That they're actually not negative. That they're positive. We just didn't know they were positive.

So if we can identify this group consistently during the staging, you may not go right to esophagectomy. They may need chemo first. And if you know that group that's destined to have negative histo, negative molecular markers, just take them to surgery. You don't need chemo.

So those were some of the lab efforts here that I've been working on the last 20 years or so. It has allowed us to learn some information. I don't think we're at the point yet, where we can take that data and apply it to patients so simply, you know, when you start to get the larger numbers. It's not so easy to make the jump from what you see in the lab to everyday clinical applications, but we're getting there.

But at a minimum, all the data points to aggressive esophagectomy with aggressive lymph node sampling. And now, there are studies that say, if you take more than 20 lymph nodes, you actually can impact on survival. Why? Certainly, if you take out 40 lymph nodes, and you get that one positive node, maybe that meant the difference between an R0 and R1 resection.

Even if not, you've now staged that patient more actively. And you can say, OK, this person has positive nodes. We wouldn't have known it unless we took the 40, or the 16, or the 18, whatever the minimum number is. But now that we know it, we know they're at high risk for recurrence. Can we say that from molecular staging yet? Not quite, not clinically.

So that was my foray into the molecular studies and the staging studies that, I think, was part of building my career, if you will, on a focused area of investigation. And this was all in parallel. I didn't say, well, let me figure out RTPCR first, and then I'll start operating. I mean, there are surgeons that do that, try to build their lab effort first. Some people say, I've got to get busy clinically first. And some people say, no, I got to pay my bills first or no, we want to have two kids first.

So anyway, I have five kids. Most recent one was adopted from China, and he's now 10. And the oldest one has just hit 40. So I wanted to do it all, and we did. And thanks to my wife, we managed to succeed. And I think my colleague here, Dave Wilson, did the same. Five, right? So it's doable.

[LAUGHTER]

Some of you I met with doing the interview, and I told you, don't put your personal life on hold. I think that you're going to be here, potentially, eight years. It may be that you'll decide to have children here. We've had people out on paternity leave. Jenny Lidle had two children here, and I'm not sure she actually had to make up any time. I don't know how she did it. But nevertheless, you got to live your life.

So this was all going on in parallel. We weren't saying, wait for esophagectomy, or wait for staging, or wait for PET scanning. There was just one big smoke storm, really, and that was thanks to a lot of people here, whether it was Omar coming to me initially as a general surgeon to do minimally invasive bariatric surgery, or Neil Christie coming to me from the Cleveland Clinic, interested in advancing his skills in minimally invasive surgery and staying on. Arjun Pennathur coming to me from Mass General.

So lots of people in the room were instrumental in all these things happening. So the acknowledgments are not just me. This is a group of people and still is a group of people. And some of our recent additions, like Netyu in robotics or Pablo in lung transplant, are incredibly important to you for me to maintain balance in an era of expanding clinical opportunities for you.

So without a robotic program, I don't think we have the same program. Without a successful lung transplant program, we're not the same program. Every one of those are going to play an important role in your training.

Now trying to decide how to do minimally invasive esophagectomy. Well, nobody could agree on how to do it open. So you'd like to take the gold standard operation and duplicate it minimally invasively. Well, that's great, except Mark Orringer over at Michigan said you had to transhiatally. Well, if you went over to Germany, they said, no, it has to be a two-hole, open chest, open belly. Nobody was saying it could be done minimally invasively. I can assure you that.

But we really couldn't find the ideal operation. But what was clear is that it seemed that nodal sampling, maybe nodal resection, negative margin was clearly important to survival and staging. Could you overdo it? Well, the Japanese did a third field of node dissection and especially in the area of adenos, where all the action's down here. And what the did was found significant morbidity. 50% trach rate, 15% phrenic nerve injury rate when they got up into an area that thoracic surgeons are not so familiar with.

We don't do a lot of neck surgery. So we start digging around the neck for a disease. It's now clearly at the lower third of the esophagus. There seems to be no benefit for that third field, so we don't do it. But I think, you have to figure these things out along the way.

So the data coming out about aggressive, open chest, open belly said that there was a trend of lower recurrences. So we kind of adopted that. We didn't want to do it all transhiatally. The survival wasn't statistically significant, the difference. So you could argue at the time, well, maybe we shouldn't do such an aggressive node dissection, because there's no data to show that it improves survival.

But there was a better local recurrence rate. We knew that. And we knew from some of the work going on at Memorial that the better lymph node count, the better staging. So we knew that. So we wanted to err on the side of looking at a more aggressive node dissection, even though, when you looked at this, you would say, you could do it either way. Doesn't make any difference. The survival is the same. So there was still some disagreement, and there is still today, although, I think, less so.

Now transhiatal versus the more aggressive transthoracic. I think there was data to say that your local recurrence rate would be different. And Nasser Altorki did a nice review. Nasser's at New York Hospital, and I trained with him and David Skinner, part of my training. Part of my success was when I was doing the training at Memorial. You did your hearts over at New York Hospital.

Well, it turns out that David Skinner was there. And for those of you that are historians, he was a major force in esophagus surgery at the time, and Nasser Altorki was his understudy. So every week, every Friday, I got to scrub with Skinner on my cardiac rotation. And so I'm doing esophagectomies, and I'm supposed to be over there doing cardiac. But none of the cardiac fellows wanted to do them, so it was great for me.

So anyway, I got to work with Nasser. He's a great guy. If you've met him on your interviews, you'd be lucky to work under a guy like that. Although, I think our program is far superior.

[LAUGHTER]

Not necessarily superior to Nasser. He's a real unbelievable guy. But what he showed with the study was that if you did a transhiatal, and you looked at these studies and did a meta analysis of them, there was a 40% local recurrence rate and mainly because the node count was poor. How do you get nodes in the chest when you're operating from the belly?

So if you've ever done a transhiatal, you're kind of sloshing around from the neck and the belly, trying to reach your fingers. It's a scary thing. And we're not, in general, very good in the neck. Mark Orringer is, but not very many general surgeons. You'll see, when you walk around, and when you do your general surgery, we don't do a lot of neck work.

You're not the one doing the endocrine work on the thyroid. Generally, you're helping, but you're not going to be doing that as a senior resident. And we don't go to the neck very often anymore. Even [INAUDIBLE] were doing transoral stapling for the vast majority.

So when will you get neck experience? Because the tumor is-- now we're all down here, so we don't go to the neck. So there are a lot of reasons why I wasn't keen on a transhiatal approach for the neck anastomases or so-called three-hole McKeown. And this was the best argument against it, because you weren't going to get the nodes. You were going to have a high local recurrence rate. So forget about it.

Now this was a three-field study I talked about from Japan. The main issue there was they could do it, but the complication rate-- very, very high when you went to the neck. And I'm partly putting this up here, because for those of you that are tempted to think, well, maybe McKeown will work for adenoids, too. And it will, but how good will you be in the neck? Because if you're not very good, this is what you're going to be faced with-- recurrent nerve injuries, lots of complications in the neck. So you, in general, stay out of the neck.

Now, I'll show you a study here that me and a couple of my colleagues are actually very good in the neck. But we trained in an era when that was still necessary. The disease just doesn't require it today. Now if we see a trend towards higher cancers, well, then we've got to get better at it. And if you see a cancer that you need to go to the neck for, you need to work with somebody that's pretty darn good in the neck, whether that's me, or Netyu, or Omar, or whether that's an ENT colleague wherever you go.

And that's maybe all you can find that has experience in that. You can't just go to the neck if you're not comfortable there. You've got to get an ENT colleague to help you or someone, like a Mike Orringer, that's out there that has experience in the neck. Because this is what's waiting for you if you go there without experience, for sure.

Now what was going on at the time with open esophagectomy, more or less, a really high mortality, maybe the highest mortality of any major operation, even whipple. So this was published not that long ago in *The Medicare Database.* And if you sampled it today, it's not that different if you look at the global, at-large surgery in those patients over the age of 62.

The better, higher volume hospitals had an 8% mortality. I have never had an 8% mortality. And the surgeons I worked with at Memorial never had an 8% mortality. So you can get it down just by working in a center of excellence. So it's not just minimally invasive. It's experience.

So you can get that number down. I don't know if you can get below 1% where we are today. But nevertheless, you can get it down. But a staggering 23% open esophagectomy at low volume.

So what's a patient to do? Well, the consumer has got to be aware, and I tell patients that every day. In fact, we just signed up a patient from Hopkins because I taught him. I said, well, I love Steve Yang. Where's his series on esophagectomy? Has he published 1,000, 2,000, 3,000? Where is it?

Now if you told me they were going to get Mark Orringer, he's got the data. Now, he's retired. But there are some people there that are pretty good at it. So you can find centers of excellence, but they're not always at the top 20 *US News and World Report.* Not everybody is good at every operation at every one of those centers. So this is a problem.

Now you can get here, again, with experience. I don't care how you do that operation-- thoraco-abdominal. If you're good at it, you can get that mortality down, but you're going to have morbidity. Less invasive approaches may help us lower morbidity. That was the buzz word, right? Volume, volume, volume first, because we know from the Berk and Meyer's study and others that if you look at low volume mortality hospitals for esophagectomy versus high volume, it's always better in higher volume.

And that's not, like, rocket science, but it's amazing how many patients come to me for a second opinion. And I simply ask them, did you ask the other surgeon how many he had done? Oh, no. Did you ask him, what's his mortality rate? Well, he said he's pretty good at it.

OK, well, I mean, we tend not to remember our mistakes unless you're actually publishing them. And when you publish them, you find that high volume surgeons do better. So in our group, we have 23 people doing general thoracic surgery. Four do esophagectomies alone. Out of the 23, only two do lung transplants alone. Only one does pectus excavatum. Only a couple do first rib.

So if you're going to come to our group to work, you're going to work with an expert. And I would venture to say that if you're going to go out and practice, you don't want to be a jack of all trades. You want to join a group or at least have a referral pattern that you can do what you do really well. But don't practice on your patients. There's no reason to.

This would tell you that high volume is where you got to be. So how do you get to high volume? Well, you train in a high volume place, like I did and like you would here. And then you join a mentor group, where you can get your own volumes, and you can develop the skills to do these operations with a lower morbidity.

Now the less invasive approach, I don't think I have to convince anybody here. This was all happening in the gallbladder area. We're going to get a lower morbidity. Remember the gallbladder and all the bile duct injuries? It's not that clear that you're going to do that with small incisions.

There were lots of complications, even today, with robotic heart surgery. And that's why some programs jumped out. Oh, we're going to do robotics. All of a sudden, hmm, robots aren't that good. I'm going to do a sternotomy. Why? Because they struggle. We struggled here early on with our robotic mitral program.

I think, by the time you come-- for those of you that will ultimately come here-- the robotic program will be up and running again for cardiac, but Netyu's got now four of us credentialed in robotics for esophagus work and for lung work. But we took a very conservative approach to our minimally invasive approach, that is, who should be doing what, and with our robotic approach, and, actually, with even tracheal diseases. Not everybody does tracheal because there's so little tracheal work.

But nevertheless, getting to this lower morbidity operation. I looked around at the time. There were almost no studies out there. This wasn't published yet. But I knew Lee-- general surgeon, quite good, laparoscopic leader. And I watched his video-- not pretty, not pretty at all. He got through nine. He ultimately published it, but he didn't talk about his lymph node dissection. He didn't do one. He just got through the operation, got the esophagus, got it hooked up.

He didn't even talk about alive or dead. This is what was available at the time. There wasn't much going on in minimally invasive surgery.

And what was a minimally invasive operation? Lee was doing it transhiatal. So he'd put a laparoscope in, puts a scope in from the neck, and ultimately connected the dots. At the time, this was published in 2002 and represented the previous 10 years of work. And there are lots of hybrid operations.

But we knew very well from our lobectomy data-- because we were doing VADs lobectomies early on. I did my first VADs lobe in '95. But what we found out real quick that putting a little retractor in and cranking it open negated all the advantages of minimally invasive surgery. You can make a small incision. But if you crank open that retractor, and crack ribs, and spread ligaments, you're going to have the same pain or more than an open incision.

And one of my mentors, David Skinner, we did big incisions, but we weren't allowed to open that chest more than five centimeters, period. That was it. You had to sneak your hand in and out in a five centimeter incision. Because he recognized the value of less invasive procedures wasn't necessarily the skin incision. The size of your access incision, whether it's esophagectomy to get the esophagus out through a wound protector or a lobectomy isn't all about just the skin incision. It's about what's happening on the inside.

So we began to find out that all these hybrid operations made no difference. In fact, there were more complications. And it was only those that started to approach totally minimally invasively that had some promise, at least that was my opinion at the time. So this was kind of our algorithm at the time of how we handled things. This lap VAD staging was a big part of it, and then we would go on. For early stage patients, we were planning to attempt them minimally invasive all the way.

So my first patient was a 48-year-old lady. She was 4 foot 11, weighed 95 pounds, and had high grade dysplasia of the esophagus. And at the time, that was an indication for surgery because of the very rudimentary ability to do EMRs at the time. And we found that virtually 30% of patients that had the pre-op diagnosis of high grade dysplasia actually had an invasive cancer.

So the state-of-the-art was to operate on everybody with high grade dysplasia at the time, so we operated on her. We did it totally laparoscopic. I worked with Ninh Nguyen and Phil Schauer, our general surgeon. And I did virtually all of the operation myself.

Her distance from xiphoid to the sternal notch was really only about six inches. So I was able to do everything laparoscopically, way up. And you'll see when we work doing giants and things, we get the scope up under the carina all the time. So I got quite high, got to neck, made the incision, dissected down with the mediastinoscope, and we did it. For hours, first case, skin to skin.

Lady did great. Not too many lymph nodes were harvested. No recurrent nerve injury. She did wonderful. Went home a few days later, and I thought we were done with it. That's when I got the note from Starzl and Bahnson that we're off to a new era, right?

Second case-- the next day, we're anxious now. This guy wasn't so easy. He was 6 foot 3, prior open gallbladder, T3, N1, 13 hours. We got through it transhiatally, but you can imagine how hard it was in a guy this big. Because men, where do they put their excess weight? Tends to be right here. And so working on a man that's somewhat obese is challenging because of the mediastinal fat, the fat around the stomach, et cetera.

Anybody can have it. But I can tell you, men put their weight here. It's just hormonal. So the second case was a real struggle.

So we began to think, really, can we take those T3, N1s right now to surgery? Well, you'll see what we did. Our first experience we published was on 77 patients. And we tried doing them laparoscopically in the beginning.

But right away, I had been doing the staging I talked about through VATS, and, man, it's a beautiful view. You put the scope in, and you can see the esophagus from stem to stern, easy to access in a non-adhesion patient and not a big tumor involving the carina or something like that. So right away, I wanted to get into the chest.

We tried a few with the laparoscopic right thoracotomy. But again, we noticed right away morbidity. Rib spreading, lots of pain, didn't seem to help. Now these were anecdotal. We didn't have p-values or statistics. That first esophagectomy, there was no IRB. This was [INAUDIBLE] down in room 25 doing esophagectomy with Phil Schauer, getting nodes from Tom Starzl.

That a boy. We went through 600 [INAUDIBLE] the first year. We killed a few, but you know, we put them on the map. Keep going, guys. So we had very little controls. Now I will say, in on first 77, there were no emergent conversions. We opened four because of adhesions, and we got 59 of them done.

The hospital stay wasn't too bad. And the ICU stay, et cetera, all these were landmark compared to what we were doing open. Lymph node dissection-- not bad for our first 77. And there were not one single mortality. So this went on to be presented at the American Surgical. Lots of controversies back then about presenting something like this at the American Surgical, a very conservative group of surgeons, which I'm proud to be in today, but not so conservative.

There were two people who stood up to support me-- Griff Pearson, a very forward-thinker from Toronto, who has since passed, but a real giant. And there will be very few of you that go into thoracic surgery that won't be touched by Griff Pearson, because many people in this room, in one way or the other, were trained by Griff Pearson or his disciples. Toronto was the home of thoracic surgery, for sure, in North America.

I got lots of encouragement from him at this meeting. And Mark Orringer stood up and said, you know, let's not criticize Jim too harshly, because there were a lot of critics. And he said, you know, I presented my first transhiatal experience here 20 years ago. And today, it's probably the standard of care in the United States. And he pointed to many people who criticized him at the time for presenting such heresy.

And he said, you know, maybe he's onto something. 77 without a single death, first of all, that's pretty good. And the lymph node count-- not bad. We evolved the operation as we were going, and then we compared it to the Orringer series. And it wasn't too bad.

His first 1,000, he had a 4% mortality. Now we had only had 77 at the time, but it was zero mortality. We're off to a good start. And the good thing was, for those of you that have seen some series with robotics or whatever, where you have all these complications in the beginning, that part, I think, is unacceptable. I think, we have to be able to venture into new operations with a very, very low risk to our patients, however you do it.

I don't care if you do simulator training, or cadaver training, or simply get the experience in open, and go into these things step at a time. You cannot experiment on your patients. You have to be good enough and confident enough that you can pull this off. Now we had some complications, but they were all in line with the Orringer series, and he, at the time, had thousands under his belt. So we thought we were in pretty good company.

Now how are we doing oncologically? Well, we looked at our group with limited nodal involvement, every single one of these patients in an IRB study here. We did do some IRB studies, even then. And this was kind of a neat study, because these patients were filed long-term. They all had minimally invasive esophagectomy. So people wondered, oh, you're going to leave cancer behind.

Well, first of all, how many of you have even seen a transhiatal esophagectomy? All the ones with gray hair and a few of the junior people have seen it. It's still done quite frequently in the United States. But what do you do to get the tumor out? Your hand through the belly, open. There's no wound protector. There's no sac you're going to drop the tumor in. You're in there sloshing tumor and lymph nodes around.

From the neck, you're trying to reach it. How is that oncologically sound? And how many times did Mark Orringer have a local neck recurrence? Almost never. So tumor cells probably aren't destined to metastasize just because you break a tumor. It's not that we want to break a tumor out and shake it all over the belly.

But for the most part, the tumors are embedded in the esophagus wall. They're T3, T2 tumors, right? So oncologically, I knew we were on stable ground because of the experience with transhiatal and doing everything humanly possible to disperse tumor cells throughout the body. And they still didn't.

So we looked at our local recurrence rate. Toni Lerut had a 5% local recurrence rate after that aggressive. And our local recurrence rate was 6%, well, actually, less than 5% at 40 months. So we were in good company.

So what I attempted to do at every step was to compare my operation to the best open. And at the time, the best open was transhiatal, so I compared it to Orringer. And at the time, the best on block was Toni Lerut in Belgium. So I compared the local recurrence rate to him. This was without radiation.

So does everybody need pre-op radiation? No. Now we didn't take bulky N2 disease. These were all with limited node disease. But every single one had node-positive disease. And we had a 35% five-year survival, which was better than any of the trials at the time.

Were they cherry-picked? No, every single one had at least a node. And if you look at all the series out there, and you take out their T1s and T2s, their survival plummets, for sure. Any study, if you cherry-pick a lot of early stage patients, you're going to improve your survival. So you got to look for that.

Now what does this tell you? This tells you, if you come to a program like this and get well-trained, you can go out and do this operation. This was Ninh Nguyen, my first fellow, who's at UCI. I'm going to visit, actually, later this month. He actually won a Faculty Award here last year. He got the Faculty of the Year Award we give once a year to people that have graduated from this program.

So anyway, this was his first year in practice at UC Davis. He joined a group. There were a couple of old-time thoracic surgeons there. Not much going on in general thoracic, and so he joined the group and did his first 18 minimally invasive. Those are the 18 minimally invasive compared to transhiatal and transthoracic. And pretty favorable compared to the best open experience in his institution.

He was doing more lymph nodes in his first 18 cases. His hospital stay was half of the open group's. Now we're much lower than this today. But even his ICU, everything was better in his minimally invasive. So he was highly regarded there. People supported him, because he came out and did his first 18 esophagectomies the first year, putting him into almost a high volume category, and he did a great job. No mortality, first 18.

Now what were we doing after those first few? Well, this was our initial experience with laparoscopic. We didn't like it. It was hard. That first lady was easy. She was small, about 4 foot 11. It was great. But the second guy wasn't so easy.

So we began to say, look, let's look at lap VADs, which was, more or less, the three hole, and then looking at Ivor Lewis. And partly, this transition was taking place because the disease was changing. Remember, the biology of this disease when I was in my training was squamous. And now, in the last two decades, it's become adeno. So we didn't have to go to the neck any longer. So we evolved. The procedure evolved based on the biology.

You don't have to do any pharyngeal dissections, so there's no recurrent nerve injuries. Less gastric tip, because you can trim off that excess. You don't have to take it to the neck. So lots of advantages for the Ivor Lewis.

But if you looked at our experience-- I'm going to jump up a little bit, because we're to run out of time if I don't. Well, let's see, maybe I don't have that slide. But we looked at the actual differences in complication between the Ivor Lewis and the three hole. The mortality rate for the three hole was about 1.9%. And the mortality for the Ivor Lewis was 0.9%. It wasn't statistically significantly different.

The nodal count was slightly better. But remember, we were going in the chest in both operations. The McKeown was still chest, belly, neck. Ivor Lewis being belly, chest. So we decided that, based on the ease of the operation-- less gastric tip ischemia, less recurrent nerve injury-- that we would stick with Ivor Lewis as our standard for adenocarcinoma. We still do McKeown's today for that high Barrett's or for the squam. So you still have to know how to do it. You still have to be good at it, but it's not our standard.

So as we evolved here-- I'm going to kind of wind this down, so we can finish up-- quality of life-- important. And we have a number of people in the group. Chris Fernando was very instrumental in studying quality of life here, Katie Nason, Arjun Pennathur, and others to show that, if we do the operation right, these patients do go back to a normal lifestyle. They actually do have good quality of life, normal compared to our own population and compared to their preoperative status.

Heartburn-related, which everybody used to say, oh, they're all going to have bad heartburn. Well, they're all refluxers, because you've cut out the lower esophageal sphincter. But if you educate them well, and you give them a narrow tube, and you give them an infradiaphragmatic reservoir, really, only 4% have severe reflux. Now if they don't follow some of the rules, if they don't eat proper, they overdo things, of course, they're going to struggle a little bit. But, by and large, we do well.

Now I think that, in the interest of time, I'm going to go through this very quickly. Laparoscopic, that's how we do the belly part. [INAUDIBLE] the tube that's [INAUDIBLE]. I think, keys to the operation-- again, I'm summarizing-- are if you're not handling the [INAUDIBLE] right. We call it the nodal [INAUDIBLE]. So we're going to grab anywhere but the tip of that conduit. So we to leave that conduit completely untouched. And if we do that, we wind up with a very good ability to get the [INAUDIBLE] right back out, make the conduit, et cetera.

We like a narrow tube. Today, we're in the middle of another IRB trial looking at pyloroplasty-- yes, no-- in the era of the narrow gastric tube. Our current gastric tube is 3 centimeters, staple on your greater curve. And we've been randomizing now for about a month. But it's designed to have 200 patients in it. We'll probably be done after a year or so. WE have a high volume. So we'll know more, but the point is, let's make the operation better. Let's put some evidence-based medicine behind it.

We're talking about how long the NG tube should be in. Should you do a pyloroplasty or not? Many issues are still not based on evidence. They're based on how your last patient did, to some degree. So we're trying to get that done.

Now I'm going to summarize, because I think we're over time a little bit. This is a video I showed at American Surgical 20 years ago. People were concerned about the oncologic soundness of the operation. Could you get all the cancer out?

There were a lot of critics. But as I showed this video, there was a lot of silence in the audience. Because what you're going to see here-- and this video is 20 years old, published in *Video Journal of Cardiothoracic Surgery* many, many years ago. But this was really revolutionary. Because what you're going to see here is we were on the trachea, the aorta. There was no more tissue to take.

I was used to operating with Skinner and Altorki and doing radical esophagectomies. So when we dissected out the trachea and the aorta, the room, in terms of critiques-- that's the left main bronchus, left atrium, right main bronchus. We took all the tissue out. We're doing a radical, minimally invasive esophagectomy.

So this video alone silenced a lot of critics. And of course, our nodal count and our five-year survival took time to get to. But nevertheless, that's what it did. I wouldn't say we perfected the operation. We're looking at things, like omental flap. That's going to be studied here. We're looking at pyloroplasty, as I mentioned.

The other things we wanted to do before we finished up here-- and these are just showing some of the other interesting things. This was that Ivor Lewis study that I talked about. And what was interesting here was that we did do a little better with Ivor Lewis. And mostly, that had to do with node dissection was statistically better. But remember, this was also over time. So we were getting better at the operation.

Mortality, as I mentioned before, was a little better. Recurrent nerve injury was 8% when we went to the neck, and it was less than 1% when we stayed out of the neck. So that was pretty impressive.

Now we ultimately got our nerve injury rate down even lower. And it was still favorable compared to Orringer's series. But I will tell you, there's always going to be some morbidity when you go to the neck, even if you're good at it.

Now this study, I won't have time to go into. But people used to call MIE a Pittsburgh operation. People from all over the world still do come in and watch the operation. But this study took 16 centers, and we engaged a number of forward-thinking surgeons at the time. And it was a pretty interesting list of people that are up here-- Sugarbaker, Swanson, Mattis, Ninh Nguyen, Chris Fernando, Orringer, and myself. We did this operation in now 16 centers under ECOG 2202 format.

And interestingly, the mortality rate was remarkably low, even though we had 16 centers now doing it. We could only put 30 patients in the study. So it wasn't any longer a Pittsburgh operation. And what we found was that we actually did a pretty good job. The nodal count was good. It was up around 20. We couldn't publish it for 38 months. They made us wait to publish the results to show the oncologic soundness.

So this came out relatively recently in the last five years, but it was actually done close to 10 years ago. It had a good local recurrence rate and a very favorable survivor. But we were quite selective in who was allowed to enter this trial. And I think that was the key to having good results was the surgeon had to prove to us that they could actually do the operation, even though it was early in their experience. That trial took us out of the era of Pittsburgh only doing the operation.

So in conclusion, in the era of open only surgery, the debate is still not over as to how to do this operation. And even today, people argue, should you do pylora? Should you go to the neck? Should you do a feeding tube in everyone? We don't know. The evidence-based medicine doesn't guide us there. So we're working on that.

We think the lymph nodes, that argument is over because of staging, stratification, and now, some data on survival. I think, minimally invasive now has shown that it can be done safely. And there are now, actually, about 10 meta-analyses that have shown better outcomes with minimally invasive. And there's one long-term study, randomized controlled trial out of France, Biere, that now came out with five-year data to show that, not only was their two-year data, but their five-year data favored minimally invasive esophagectomy. So now, we have a lot of data to support it.

But we still don't have decisions about exactly how to do the operation based on evidence. So we recommend what we're doing, which is aggressive node dissection, aggressive staging first, stratifying-- deciding who goes to surgery, who gets chemo, who gets radiation-- and then doing the operation, as I just showed you, and then taking it to the rest of the world with ECOG 2202.

So I'll finish with this. It's very clear that evolution of a specialty is important. Now the dinosaurs were pretty good at dominating the earth for millions of years. But they failed to evolve to a changing environment, period, so extinction. I can tell you that we've dominated-- esophagus surgeons, thoracic surgeons-- for maybe 50 years. Well, this is the future of open surgery likely.

This is the feature of many techniques that are not evolving, whether you're in the era of robotic pancreatic surgery or the era of EVLP and lung transplant. The field is always moving forward-- robotics now, other things. So we've got to evolve. We've got to continue to think out of the box with lung cancer, esophageal cancer, et cetera.

So that's just a summary of what I've been doing here the last 20 years and some of the people that have helped me. Thank you.

[APPLAUSE]